APPENDIX B
SAFETY PROCEDURES

Minimum and maximum elevations, deflection limits, and minimum fuze settings must be computed to ensure all rounds impact or function within the designated impact area. These data are then presented in graphical form on a range safety diagram. They are also arranged in a simplified format (the safety T) for each mortar squad leader. This chapter discusses the computation of safety data using tabular and graphical data.

B-1. SURFACE DANGER ZONES

Range control personnel or the OIC provides the safety officer with the precise location and size of the impact area. The impact area can either be defined by a series of grid coordinates representing the corner points or lateral azimuths and minimum and maximum distances from a fixed RP. Either method defines an area on the ground, perhaps irregularly shaped, within which all rounds fired must either impact or function. The safety officer must then compute the safety limits of this impact area and construct the safety diagram and the safety T. To compute the safety limits the safety officer must consider the following.

a. **Secondary Danger Areas A and B**. The safety officer must first determine whether the impact area limits provided to him include secondary danger areas A and B. These areas are established by AR 385-63.

(1) Secondary danger area A parallels the impact area laterally and is provided to contain fragments from rounds exploding on the right or left edges of the impact area (Figure B-1). Depending on the mortar being fired, secondary danger area A varies from 250 to 400 meters.

(2) Secondary danger area B is on the downrange side of the impact area and area A. It contains fragments from rounds exploding on the far edge of the impact area. Depending on the mortar being fired, secondary danger area B varies from 300 to 500 meters (Figure B-1).

NOTE: If, the designated impact area does not already consider areas A and B, it must be reduced by the appropriate amount to ensure no rounds impact within or outside of either area.

b. **Range and Deflection Probable Errors**. The initial impact area must be reduced again to account for the normal dispersion of rounds fired. The safety officer must determine the maximum probable errors for both range and deflection.

(1) The safety officer checks columns 3 and 4 of Table E in the tabular firing tables for the mortar and ammunition to be used. He checks all possible charge and elevation combinations to ensure he has found the maximum probable errors at the distance to the far edge of the impact area.

(2) The safety officer then reduces the maximum range by a factor of 8 times the range probable error. He also adjusts the minimum range toward the center of impact by a factor of 12 times the range probable error.

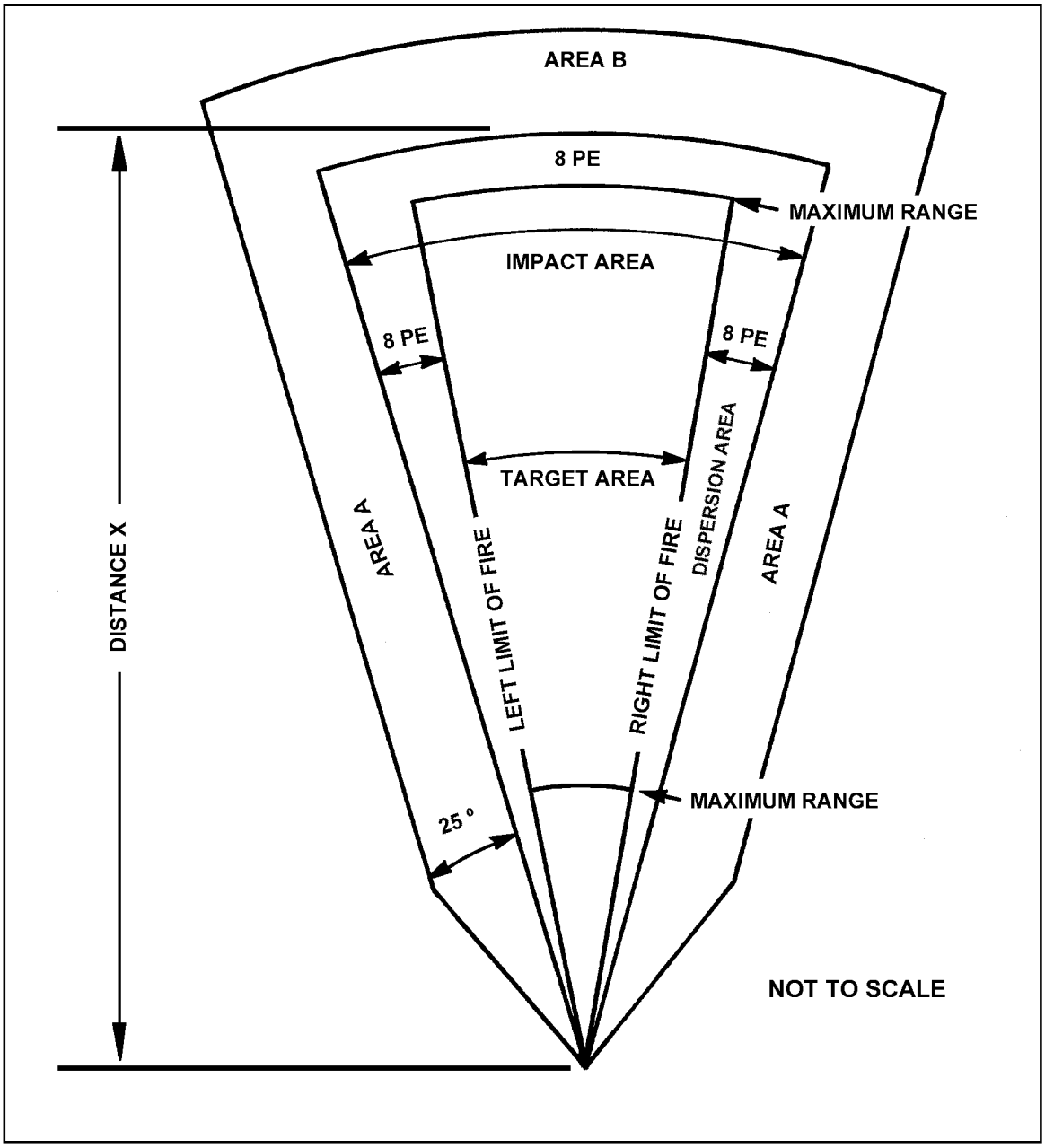

Figure B-1. Mortar surface danger zone.

(3) Once the ranges have been adjusted, the safety officer adjusts the left and right limits inward by a factor of 8 times the maximum deflection probable error.

NOTE: The safety officer must determine whether range control personnel have already performed this computation before designating the impact area.

c. **Vertical Interval and Crest Clearance**. The safety officer must compare the altitude of the mortar position and that of the impact area. If there are significant differences in the VI between these two areas, he must adjust the safety limits to preclude any rounds impacting short or long of the impact area (Figure B-2).

(1) The rule for determining the correct VI for safety purposes is called the *mini-max rule*. At the minimum range, the maximum altitude is selected. At the maximum range, the minimum altitude is selected. If the contour interval is in feet, it is converted to meters.

(2) The safety officer determines VI by subtracting the mortar firing position altitude from the altitude of the applicable range line. The resulting number is either positive or negative.

(3) The safety officer adds half the value of the VI determined for each applicable range line, to that line. This either increases or decreases the apparent size of the impact area, depending on whether the VI is positive or negative.

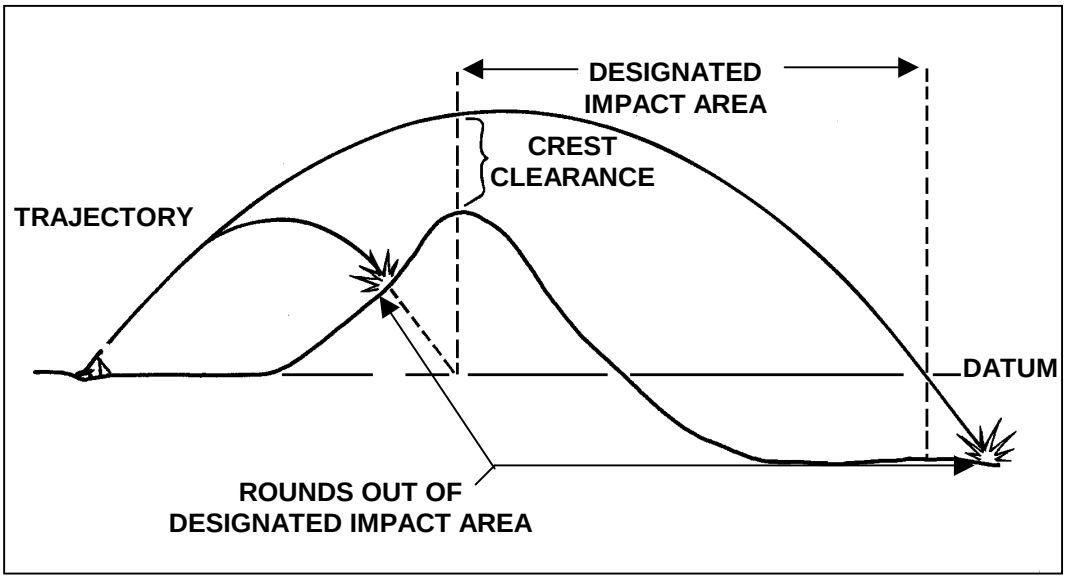

Figure B-2. Effects of VI and crest clearances.

(4) The safety officer must then make a map inspection to determine the highest point between the mortar position and the edge of the impact area. He then compares this highest point with the lowest maximum ordinate value found in Table E in the tabular firing tables. As long as the maximum ordinate exceeds the VI of the highest point, no correction need be made. If not, all charge and elevation combinations that do not allow crest clearance must be noted and applied to the safety diagram.

d. **Drift (4.2-inch only)**. The safety officer must modify the left and right limits of the safety diagram to compensate for the drift. The left limit must be moved to the left by the amount of the minimum drift for the charge and elevation combinations to be fired. The right limit must be moved to the left by the amount of the maximum drift for the charge and elevation combinations to be fired.

NOTE: Drift is a function of both time-of-flight and range. The safety officer must be careful to ensure he chooses the correct charge and elevation combination (the one that gives the minimum drift). A common mistake is to simply use the drift at minimum range, which is not always correct.

e. **Section Width and Depth (manual plotting only)**. If a mortar near the center of the section is used as the adjusting mortar, any mortar significantly left or right of this "base" can put rounds out of impact, unless corrections are made. If the mortars are arranged in the firing position with any significant depth, the rearward or forward mortar can put rounds short or long of the impact area unless a correction is made.

(1) The safety officer must determine the width and depth of the mortar section as it is arranged on the ground (at the firing position). He then reduces the left and right limits by half the section width.

(2) The safety officer adds half the section depth to the minimum range and subtracts half the section depth from the maximum range.

f. **Registration and MET Corrections**. After a registration (survey chart), a reregistration, or a MET update has been conducted and corrections have been determined, the safety officer must modify the original basic safety diagram by applying the registration corrections. New elevations are determined that correspond to the minimum and maximum ranges. Deflections are modified by applying the total deflection correction to each lateral limit.

B-2. SAFETY DIAGRAM

The safety diagram graphically displays the computed safety limits. Data are logically presented and arranged for the FDC to use. Once the diagram is constructed, data from it are used to draw the safety T.

a. The range safety officer determines the lateral safety limits and the minimum and maximum ranges of the target area. These data must then be converted to deflections and elevations. In the case of mechanical time (illumination) and variable time (VT or PROX) fuzes, a minimum time setting must be determined. For example, assume the following limits were provided by the range safety officer:

- Left azimuth limit is 4,730 meters.
- Right azimuth limit is 5,450 meters.
- Minimum range (min rg) is 2,400 meters.
- Maximum range (max rg) is 5,500 meters.
- From azimuth 4,730 to azimuth 5,030, the maximum range is 5,000 meters.
- Minimum range for fuze time is 2,700 meters.
- Authorized weapon and charge zone are the M252 81-mm mortar, and charges 1-4 (M821 HE round).
- Firing point 72 is located at grid FB60323872, altitude is 390 meters.

b. The basic safety diagram is constructed (Figure B-3) as follows:

(1) On a sheet of paper, draw a line representing the direction of fire for the firing unit. Label this line with its azimuth (AZ) and the referred deflection (DF) for the weapon system.

(2) Draw lines representing the lateral limits in proper relation to the line on which the section is laid. Label the lateral limits with the appropriate azimuths.

(3) Draw lines between the lateral safety limits to represent the minimum and maximum ranges. Label each line with the appropriate range. If the minimum range for fuze (FZ) time (TI) is different from the minimum range, draw a dashed line between the safety limits to represent the minimum range for FZ TI. Label the line with the appropriate range.

(4) Compute the angular measurements from the azimuth of lay to the left and right safety limits by comparing the azimuth of lay to the azimuth of each limit. On the diagram, draw arrows indicating the angular measurements and label them.

(5) Apply the angular measurements to the deflection corresponding to the azimuth of fire to determine the deflection limits (LARS).

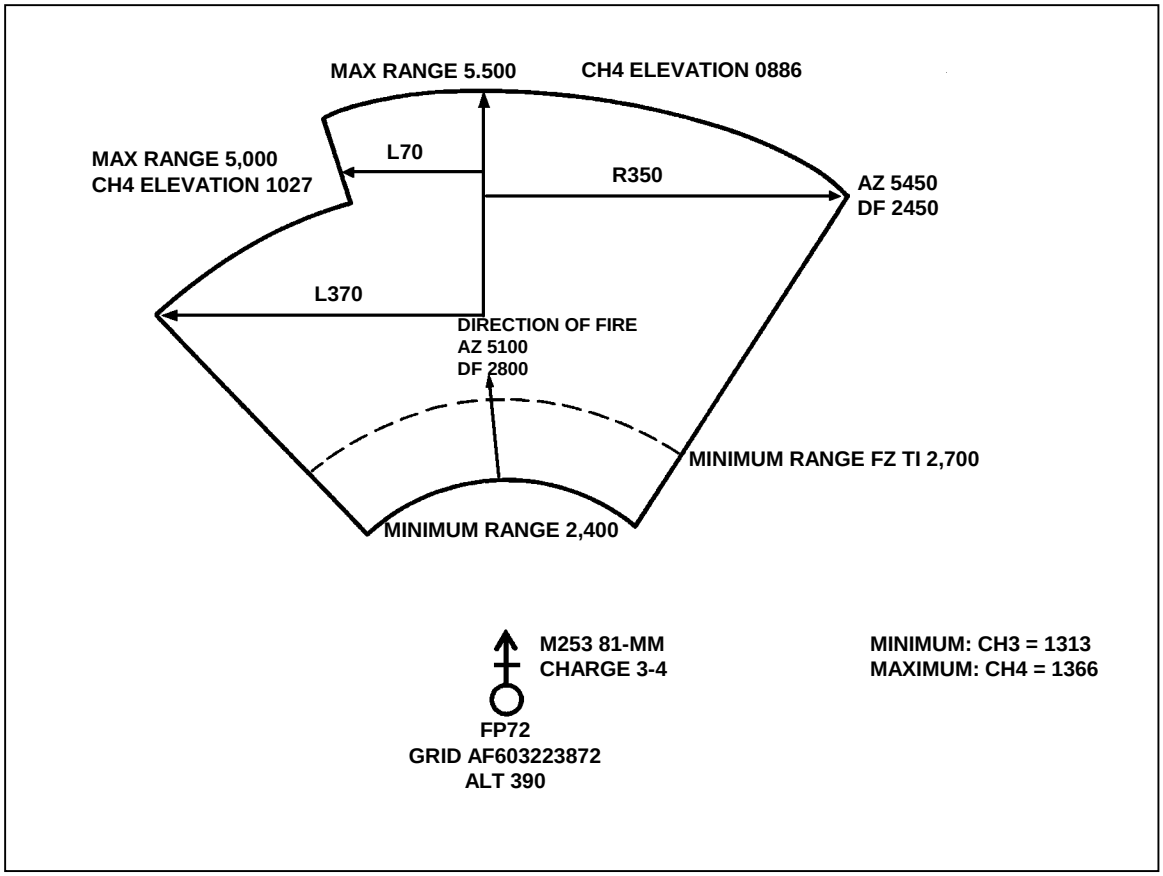

Figure B-3. Basic safety diagram.

c. Once the basic safety diagram is drawn, the FDC uses the tabular firing tables to determine the proper charges, elevations, and time settings. He then applies them to complete the diagram.

d. The safety T is a method of passing safety data on to the mortar squad leaders in a simplified form. The information needed by the squad leader is extracted from the completed safety diagram and placed on a 3-inch by 5-inch card or similar form. Figure B-4 shows the safety T taken from the completed range safety diagram.

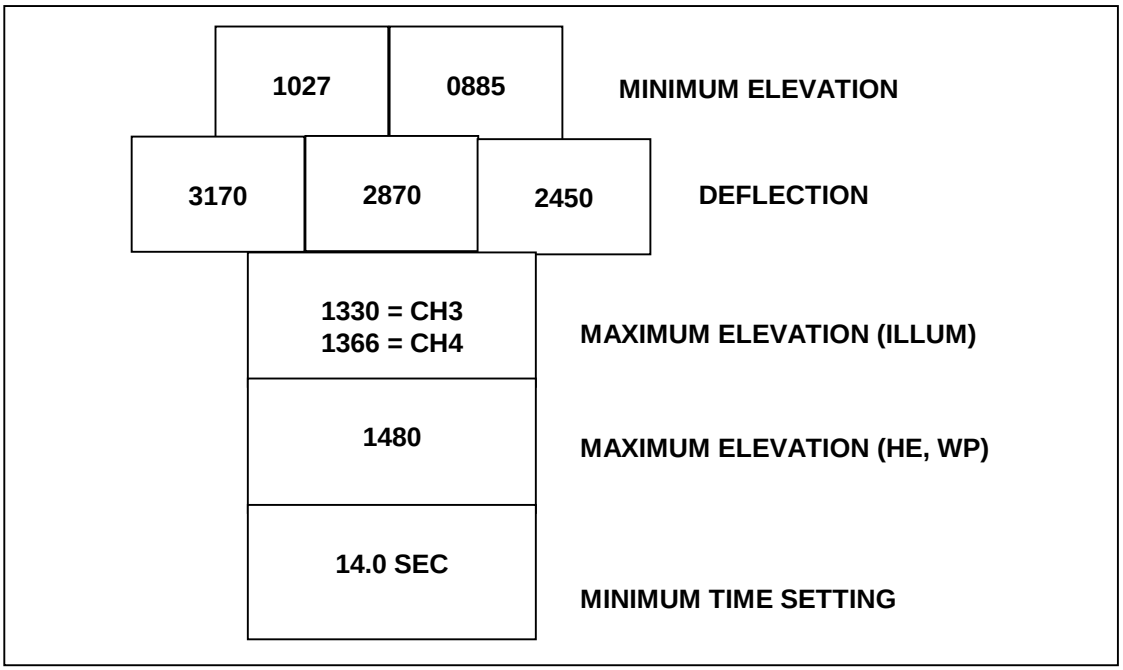

Figure B-4. Safety T.